HPRC

HEALTHCARE PLASTICS RECYCLING COUNCIL

REGULATORY BARRIERS RELATED TO HEALTHCARE PLASTIC WASTE RECYCLING IN THE EU

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EXECUTIVE SUMMARY

This paper aims to provide an understanding of legislative barriers regarding recycling healthcare plastics. In particular, the barriers related to legislative requirements applicable to the handling of hazardous healthcare waste. The paper concludes that a robust and unambiguous legislative framework does not yet exist for the recycling of hazardous medical plastic waste nor for plastic medical waste as recycled content for other applications. The paper identifies at least five conditions that need to be met to improve the recycling infrastructure for hazardous plastic medical waste.

About the Healthcare Plastics Recycling Council

The Healthcare Plastics Recycling Council (HPRC) is a private technical coalition of industry peers across healthcare, recycling, and waste management industries. HPRC's goal is to improve the recyclability of plastic products and packaging in healthcare. Simultaneously HPRC recognizes that reduction and reuse initiatives have a higher priority in the waste hierarchy and efforts in these areas must continue.

HPRC's Vision for Advanced Recycling and Circularity

HPRC's mission is to collaborate across the value chain to inspire and enable the healthcare community to implement viable, safe, and cost-effective recycling solutions for plastic products and packaging used in the delivery of healthcare. HPRC is committed to advancing a circular economy where recycled materials are used to create similar or better products.

2022 European Regulatory Requirements Project [1]

Building on insights from the Barriers to Recycling Healthcare Plastics project, HPRC launched a project to better understand legislative barriers to recycling healthcare plastics. In particular, the project focused on the barriers related to legislative requirements applicable to the handling of hazardous healthcare waste which could be infectious and toxic to certain degrees. This was recognized to be essential since there seems to be a conflict between the injunction of plastic circularity (i.e., the place and enactment of plastic circularity in legislation), the functionality of plastic circularity (i.e., the requirement of being a sterile barrier of healthcare products), and effective healthcare waste management for the purpose of recycling (plastic (hazardous)) waste. This foundational paper presents the insights gained during this research by answering the following research question:

"How can barriers to the recyclability of hazardous and non-hazardous healthcare plastic waste be identified and addressed, in relation to healthcare system practices and regulations in selected European countries?"

This research has been conducted in collaboration with Aalborg University and aims to understand the current regulations on hospital waste in various EU countries. A special focus was placed on contaminated (including biohazardous, chemical, and pharmaceutical) hospital waste. The research helps to identify where actions are needed to improve the recyclability of plastic medical waste.

[1] When referencing this source, please use the following reference: "HPRC. (2023) Exploring Regulatory Barriers Towards Healthcare Plastic Waste Recycling in the EU. Healthcare Plastics Recycling Council, https://www.hprc.org/barriers-to-recycling-healthcare-plastics"

The research has been conducted by doing desk research, following seminars, and conducting twenty guided interviews with professionals in the healthcare industry. Four countries were selected as focus areas, namely: Denmark, the United Kingdom, the Netherlands, and Germany. A visualization of the research design can be found in Figure 1.

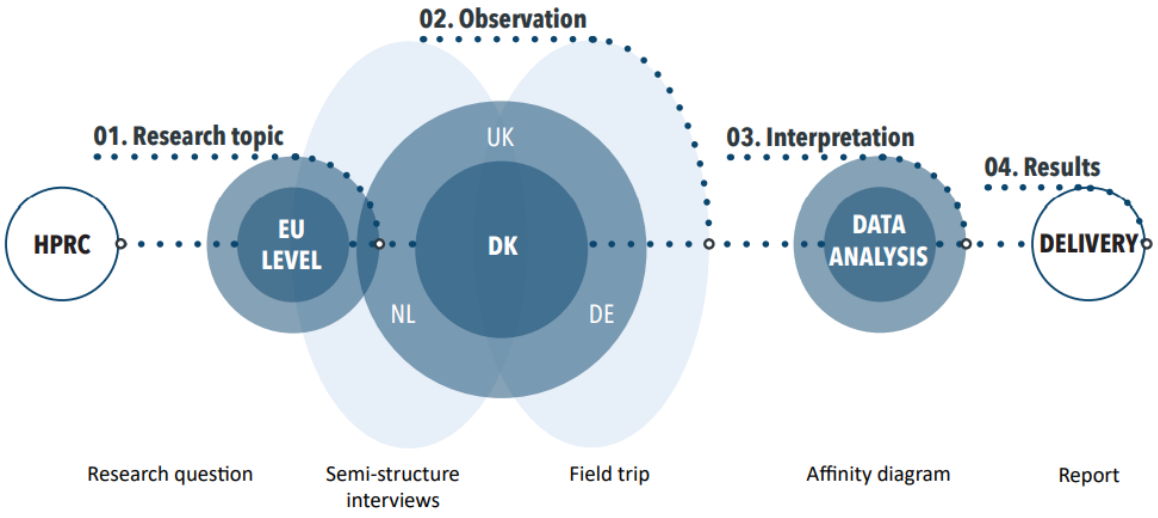

Figure 1: Visualization of the research design structure as created by the students

The identified barriers are structured into the legislation phase, use phase, and end-of-life phase. The identified use phase and end-of-life phase barriers in this research confirm the findings of previous HPRC research conducted as part of the Barriers to Recycling Healthcare Plastics project. The identified legislation-related barriers confirm to an extent findings of previous HPRC research but also provide new learnings.

The identified legislation-related barriers are:

- Legislative differences exist between the countries that were studied. The lack of specific common EU legislation for healthcare waste leads to differing approaches between EU member states. In general, existing national legislation categorizes waste by the level of risk of infection rather than recyclable materials and compounds.
- National legislation on categorizations of hazardous and non-hazardous waste can be and is interpreted differently by hospitals. As definitions of hazardous and non-hazardous waste in national legislation leave room for interpretation, hospitals located in the same country are left with their own interpretation and classification of hazardous and non-hazardous waste.
- Waste processors are also left with their own interpretation of national legislation on categorizations of hazardous and non-hazardous waste, underscoring the barrier of ambiguous definitions of hazardous and non-hazardous (healthcare) waste in national legislation.

- Legislations regarding recycling technologies and applications have not reached the necessary maturity for plastic healthcare waste to be recycled into other applications. While various technologies exist that can recycle healthcare waste into other applications (both in healthcare and in household packaging), legislation on recycling plastic healthcare waste is not mature enough to allow for plastic healthcare waste to meet the stringent requirements for other plastic packaging applications.

The current research confirms the following use phase barriers previously identified by HPRC:

- The general lack of knowledge of hospital personnel about waste sorting.
- The lack of space in hospitals and the time of hospital staff to properly sort and store the different waste streams (including the hazardous waste stream).
- The lack of guidance and/or proper hospital guidelines about waste sorting and separation.
- The multiple plastic material design of healthcare products as well as combined products of different materials in packaging.

The current research confirms the following end-of-life phase barriers previously identified by HPRC:

- (Non-hazardous) healthcare plastics often end up in a mixed waste stream of lower quality leading to lower retention of plastic quality that is only suitable for plastic products or packaging with lower requirements.
- The current low economic value of recycled materials for recycling companies.
- The expensive end-of-life treatment of hazardous healthcare waste. This can also be considered an opportunity: recycling hazardous healthcare waste transforms an expensive end-of-life treatment into a less expensive (ideally profitable) recycling treatment.
- No uniform definition of what falls under hazardous waste exists, leaving recycling companies with their own interpretation of what is considered hazardous and non-hazardous waste.

This foundational paper is intended for medical products and packaging manufacturers, hospitals, and recyclers. Its findings represent a significant step forward in understanding regulatory barriers and opportunities associated with recycling hazardous and non-hazardous plastic materials. Based on this research, HPRC concludes that:

- There is a strong awareness and willingness among healthcare providers to improve the recyclability of medical plastic packaging.

- The primary obstacles to extended recycling are economic obstacles and legislative obstacles. There appear to be limited to no technical obstacles to improve the recycling of medical plastic packaging. Critical investments into advancing the recyclability of medical plastic packaging by healthcare organizations and national governments appear to be lacking as the recycled content from medical plastic waste is considered to be of low economic value. Furthermore, a robust and unambiguous legislative framework does not exist (yet) for the recycling of (hazardous) medical plastic waste nor for plastic medical waste as recycled content into other applications. The mass balancing of plastic medical waste as recyclable and recycled content has not reached its maturity yet. Sophisticated sorting and recycling technologies for plastic medical waste are advancing quickly and are not deemed an obstacle in recycling efforts. Proven examples of advanced sorting and recycling technologies at scale exist within the consumer goods industry.
- At least five conditions are identified that need to be met to improve the recycling infrastructure for (hazardous) plastic medical waste:
    - Alignment of unambiguous legislation within and across European member states;
    - Appropriate categorization of plastic healthcare waste to ensure recycling readiness;
    - Evolution of device and packaging legislation to enable the inclusion of curated recycled content thereby creating an economic incentive for the circularity of healthcare products;
    - Effective hospital infrastructure and design of hospitals; and
    - Effective hospital workflow and staff education.

This research and its findings are but one piece of a bigger mission and vision of HPRC. While this paper is particularly focused on regulatory barriers for plastic recycling, HPRC undertakes various research initiatives along the healthcare plastics value chain. It has, among other things, created recycling guidance tools (HospiCycle) for hospitals interested in recycling healthcare plastics and/or interested in improving their recycling program. In addition, HPRC has developed a guidance document for manufacturers that articulates design considerations that enhance the recycling potential and value of the final product or packaging. Through exploring advanced recycling technologies, HPRC also addresses opportunities to expand current healthcare recycling capabilities with its Advanced Recycling research.

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Additionally, we would like to thank Wendy Gunn, Associate Professor of Collaborative Design in Design Engineering at Aalborg University, and Monia Niero, Associate Professor at Sant'Anna School of Advanced Studies (previously working at Aalborg University). Their supervision and support for the students and for their interest and effort in partnering Aalborg University with HPRC were highly valued.

Lastly, we would like to extend our sincere thanks to all the healthcare professionals who have devoted their time and effort during the students' interviews and field trips by sharing their experiences, learnings, and ideas.

INTRODUCTION

Plastics, in particular plastic packaging, are essential in today's state-of-the-art medical technologies for improving worldwide healthcare and for delivering safe and effective healthcare services globally. Over the years, an abundant variety of plastics has been developed and produced to meet the stringent standards of healthcare applications and patient safety requirements. Therefore, these plastics need to be of high quality and purity in order to meet health and safety requirements. In general, the recycling of plastics into high-quality materials is considered challenging and complex as a consequence of the large range of different compositions and types of plastics. This is even more so the case for recycling hospital plastics, even though the materials used for hospital plastics are of the highest chemical value.

In 2020, the global healthcare plastics market was 14,5 million tons, and market analysts project that it will grow by 5% annually to 22 million tons by 2025[2]. Simultaneously, the European Union increasingly drives plastic reduction and

[2] Source: BBC Research Reports PLS007F (Sept 2020) and PLS009K (Nov 2020).

circularity with the European Green Deal, the Packaging and Packaging Waste Directive (PPWD), the Extended Producer Responsibility (EPR) strategy, and the ban on single-use plastics. The number of plastics produced for, used, and discarded in the healthcare industry can, according to HPRC, be reduced considerably by looking for scalable solutions within the value chain of healthcare plastics. Therefore, the aim of this research is to contribute to advancing the circular economy in the healthcare industry, in particular with regard to plastic healthcare packaging. In order to create scalable solutions advancing a circular economy, the barriers to sorting and recycling need to be identified and researched in depth.

Based on previous HPRC research, a perceived barrier that is experienced by various parties in the value chain is a lack of or insufficient knowledge about the regulations related to contaminated hospital plastic waste. What should be done with contaminated hospital waste is often unclear and involves several limitations. Additionally, the potential hazard of healthcare waste is one of the most frequently heard objections to sorting and recycling. There seems to be a conflict between the injunction of plastic circularity (i.e., the place and enactment of plastic circularity in legislation), the functionality of plastic circularity (i.e., the requirement of being a sterile barrier of healthcare products), and effective healthcare waste management for the purpose of recycling (plastic) waste. A concern was shared by Health Care Without Harm in 2020 regarding the incorrect aggregation of hazardous and non-hazardous healthcare waste. This results in the treatment of previously domestic-like waste as hazardous waste, thereby preventing the recycling of recyclable healthcare waste[3]. Another perceived barrier is that it is often unclear how hospitals can create economic value from the recycling of plastic medical waste as the costs to recycle and sort often seems to outweigh the economic benefits, likely exacerbated by legislative uncertainty and confusion regarding plastic medical waste regulation.

Understanding the current regulations on (contaminated (including biohazardous, chemical, and pharmaceutical)) hospital waste in different EU countries and the interpretations of these regulations helps to identify where actions are needed to improve the recyclability of plastic medical waste and thereby create an economic incentive for circularity of healthcare products. Addressing the previously identified regulatory barrier, HPRC has initiated this research to expedite replacing the linear use of plastic medical packaging and the current waste management with a circular alternative. For this, HPRC valued an out-of-the-box approach and mindset. Therefore, this research has been established based on a collaboration between HPRC and six students (and their supervisors) of the MSc. Sustainable Design Engineering of Aalborg University as part of their module 'Staging Collaborative Design for Sustainability'.

[3] Source: HCWH Europe (2020).

RESEARCH SCOPE AND METHODS

The central research question of this research is ''How can barriers to the recyclability of hazardous and non-hazardous healthcare plastic waste be identified and addressed, in relation to healthcare system practices and regulations in selected European countries?"

The research question has been explored from two angles:

- Potential discrepancies between EU-directives, national regulations of EU member states, and practices that act as barriers to recyclability, and
- Potential differences in waste management of plastics from hospital clinical settings in EU member states.

Denmark, the Netherlands, the United Kingdom, and Germany were chosen as focus areas based on the differentiation of waste management approaches and regulations, the size of the country, the amount of generated waste, available contacts, and language. Despite no longer being part of the European Union, the United Kingdom was selected as it is still influenced by European regulations. With the selection of the four countries, the aim is to feature the similarities and differences in plastic healthcare waste management practices and the various interpretations of EU regulations that exist in the four countries. Denmark was used as a base country as the students are based in Denmark and could gather empirical data by doing field trips. Consequently, Denmark was used as a template to compare the remaining three countries.

The first research phase consisted of desk research and seminars. In addition, twenty semi-structured guided interviews were conducted with professionals in the healthcare industry. An anonymous overview of the profiles can be found in Annex A. Three phases were discussed during the interviews:

- The targets and legislation phase (regarding the manufacturing of plastic packaging in healthcare).
- The use phase (focusing on the sorting practices of plastic healthcare waste at hospitals).
- The end-of-life phase (focusing on the disposal of plastic medical waste).

In addition, one field trip to Denmark's Bispebjerg Hospital was done to gather empirical data. A visualization of the created research design can be seen in Figure 2 below.

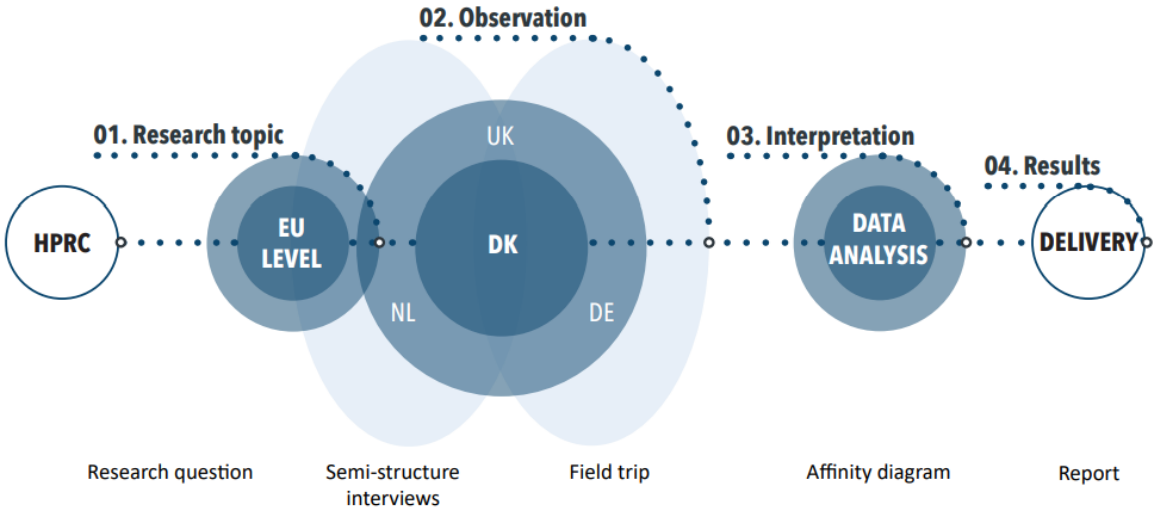

Figure 2: Visualization of the research design structure as created by the students.

KEY FINDINGS

The key findings of the research are presented below. They are structured in barriers regarding legislation on healthcare plastics, the use of healthcare plastics in healthcare organizations, and the end-of-life phase of healthcare plastics.

Legislation Barriers

The first identified obstacle within the legislation phase is the various understandings of what should be categorized as hazardous and non-hazardous waste in the national legislations of Denmark, the UK, the Netherlands, and Germany. Table 1 shows the main legislations and guidelines of the four chosen countries regarding the categorization of healthcare waste. A difference can for example be seen in the categorization of plastics that have been in contact with non-infectious bodily fluids. In Germany, those plastics fall under 'general waste' whereas in the Netherlands they are considered 'hazardous'. The definition of hazardous waste is not uniform throughout national legislation since there are different terminologies used such as infectious, hazardous, and offensive waste. Upon reviewing the existing literature, there is an apparent lack of common EU legislation on the handling, transportation and disposal of (hazardous) healthcare waste, leading to discrepancies between countries. As disposal and segregation of healthcare waste are regulated nationally by each member state, differences inevitably exist between EU countries. Visualizations of Danish, British, Dutch, and German legislations regarding hazardous and non-hazardous waste can be found in Annex B.

As for the second obstacle within legislation, despite the given examples provided in several regulations about waste types, hospitals are left with the individual responsibility of creating detailed definitions of infectious waste, leading to discrepancies between hospitals within the same country. The definitions and categorizations of (hazardous) healthcare waste in national legislation are not

detailed enough, leaving hospitals with their own understanding and categorization of (hazardous) healthcare waste. As there is both a lack of EU guidance as well as national guidance in legislation, hospitals are left with their own interpretation of what is considered hazardous and non-hazardous waste. The same challenge (and third obstacle) can be found in sorting and recycling practices by waste processors. This leads to a lack of visibility on the amount of hazardous and non-hazardous waste, thereby hiding the true scale of opportunity that exists in sorting and recycling healthcare waste. Furthermore, public sentiment regarding healthcare waste contributes substantially to the labeling of healthcare waste as hazardous waste. As it is often assumed that most healthcare waste comes with a significant risk of contamination, healthcare waste is often wrongly labeled as hazardous waste. Hence, public perception of what healthcare waste is comprised of has an impact on decision-making due to a lack of clear definitions and categorizations in legislation.

Moreover, there seems to be a skewed focus on current legislation. Safety and infection control are prioritized over measures that consider environmental benefits. In other words, legislation categorizes waste by the level of risk of infection rather than by recyclable material/compound. A question that arises is whether existing safety regulations actively conflict with environmental improvements or whether environmental improvements are simply pushed lower on the prioritization list.

The fourth obstacle within the legislation phase identified concerns legislation around recycling technologies and applications. Legislation around recycling technologies and applications has not reached the necessary maturity for plastic healthcare waste to be recycled into other applications. The current high requirements for plastic-quality of healthcare equipment are in place to ensure safe and sanitary products to be used in clinical settings. While mechanical recycling would result in slight deterioration every time the materials are heated and remelted, chemical recycling does not necessarily have this consequence. However, while various technologies exist that can recycle healthcare waste into other applications (both in healthcare and in household packaging), legislation on recycling plastic healthcare waste is not mature enough to allow for plastic healthcare waste to meet the stringent requirements for other plastic packaging applications. Healthcare plastics can be an excellent source of recycled content for other applications because the polymers are generally of good quality. Yet, a closed loop for plastic medical products and packaging is not possible because legislation around recycling technologies and applications prohibits manufacturers from using recycled plastic medical materials for plastic products in healthcare and other industries.

COUNTRY	GENERAL WASTE				HEALTHCARE WASTE			
	NAME	YEAR	LEGISLATION	GUIDELINES	NAME	YEAR	CATEGORIZATION	SPECIFIC LEGISLATION
Denmark	Declaration concerning waste BEK nr 2512	2021	X			2021	Non-hazardous: General waste	Municipal regulations
							Hazardous: Sharps Healthcare risk waste	Handling of healthcare risk waste (1998)
UK	Environmental Protection Act	1990 (Amended in 2022)		X	Healthcare Technical Memorandum (HTM) 07- 01	2021	Non-hazardous: Offensive waste Domestic waste	- Municipal regulations - SR2008 No 24: standard rules for transfer of healthcare waste (2022)
							Hazardous: Clinical waste Cytotoxic waste Medicines	- The Hazardous Waste Regulations (2005) - SR2008 No 24: standard rules for transfer of healthcare waste (2022)
Netherlands	National Waste Management Plan (1-85)	2019	X		19 Afval van gezondheidszorg bij mens of dier (Waste from human or animal health care)	2019	Non-hazardous: General waste	Eural code 180104, 180203
							Hazardous: Infectious waste Cytotastic	Eural code 180103, 180108
Germany	Circular Economy ActKrWG	2012 (Amended in 2021)		X	LAGA 18	2021	Non-hazardous: Sharps General waste	Municipal regulations
							Hazardous: Infectious waste Cytotastic waste Chemicals	The Ordinance on Hazardous Substances (2010)

Table 1: Legislations of Denmark, the UK, the Netherlands and Germany

Use Phase Barriers

The first obstacle within the use phase that is identified is the general lack of knowledge of hospital personnel about waste sorting. They are often not trained in identifying what materials can be recycled and how it could/should be sorted accordingly. This finding confirms previous research by HPRC concluding that given the abundance of different plastic materials used in healthcare products and packaging, the challenge of identifying what is and is not recyclable often leads to inconsistent collection of materials.

A second obstacle in the use phase identified is the lack of space in hospitals and hospital staff's time to properly sort and store the different waste streams (including the hazardous waste stream). Confirming HPRC's previous research, it was found that most hospitals' design and infrastructure did not envisage waste management beyond mixed waste. Good material segregation and collection requires adequate space for the collection of the different materials and storage until the materials are collected by waste processors. The students of Aalborg University created Figure 2 to visualize the general journey of plastics within hospitals showing the different steps and space needed.

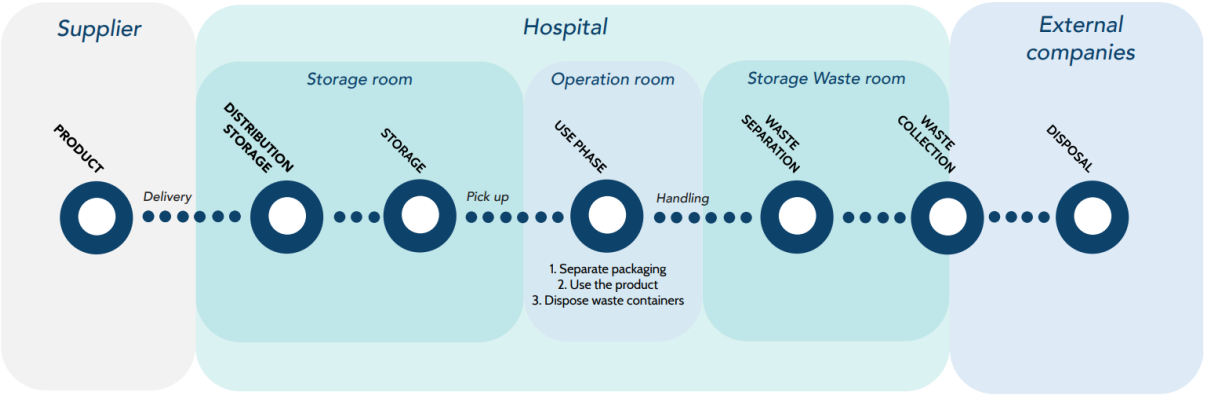

Figure 3: General plastic journey in hospitals

The third obstacle identified in the use phase is the lack of guidance and/or proper hospital guidelines about waste sorting and separation. Related to the lack of knowledge barrier, the hospital personnel that were interviewed for this research experienced a lack of top-down guidelines on how to sort waste properly. Moreover, as guidelines and waste management are determined by each country, municipality, and healthcare organization separately, there is no uniform understanding of proper waste sorting and recycling. According to the interviewees, (plastic), waste sorting is therefore often a bottom-up effort and is based on the healthcare personnel's own interest and knowledge of waste segregation.

A last obstacle that is identified in the use phase relates to the design of healthcare products and packaging. Healthcare products with multiple plastic materials in their design as well as combined products of different materials in packaging form another barrier to adequate plastic recycling. The above-mentioned design's purpose is to function as a sterile barrier and to prevent punctures but makes end-of-life recycling practices difficult. A product made from bioplastics and

petroleum-based plastics packed in plastic packaging with a paper layer makes it unfeasible for hospital personnel to separate the different materials and challenging for waste processors to recycle. Examples are pouches or trays made from two or more mixed materials that, when taken separately, are all recyclable. However, the separation of these mixed materials is difficult, hence making them challenging to recycle.

Similar to the second legislation barrier regarding the prioritization of current legislation, waste management practices in hospitals focus on treating infectious and toxic healthcare waste to minimize the risk of a negative public health impact and to protect hospital personnel who are involved in treating the waste. In addition, incineration with minimum temperature is as of yet the best practice to fully control and remove the risks. Transportation of hazardous waste requires special authorization and strict supervision, while existing incineration facilities are established routes to handle the infectious waste.

End-of-Life Barriers

The first obstacle identified in the end-of-life phase is related to the mixed waste stream (non-hazardous) healthcare plastics often end up in. Healthcare plastics are difficult to separate into different fractions and often end up together with other plastic waste of a facility that is of a lower quality, resulting from, for example, food waste and non-food packaging. This leads to a lower retention of plastic quality when trying to recycle this mixed plastic waste badge. The resulting polymer is often only suitable for plastic products or packaging with lower requirements.

A consequence of the previously identified obstacle is the low economic value of low-quality recycled materials for recycling companies. The low retention of value in recycled materials resulting from mixed plastic waste collected from healthcare facilities often does not form an economic incentive for recycling companies to collect and treat such waste. Another aspect is the expenses associated with the treatment of hazardous waste. Hazardous waste requires special and more expensive treatment with an extensive and strict process recycling companies need to follow. This can also be considered an opportunity: the more hazardous waste can be diverted from expensive end-of-life treatment (through recycling), the less expensive (ideally profitable) the waste treatment becomes. This could provide a good and well-established revenue stream leading to recycling companies being incentivized to also recycle hazardous waste.

A recurring obstacle that is identified in the end-of-life phase is the different understanding of what can be considered hazardous waste. As long as there is no uniform definition of what falls under hazardous waste, recycling companies (along with healthcare organizations) are left with their own interpretation of what is considered hazardous and non-hazardous waste. Due to the lack of a single understanding of hazardous and non-hazardous waste, uniform plastic medical waste separation practices also do not exist. Consequently, recycling facilities often avoid accepting plastic medical waste due to a fear of the badge including contaminated waste.

CONCLUSION

Reflecting on the identified obstacles shows that hospitals determine their own waste management strategy with waste management organizations that meet their needs while complying with legal requirements to manage hazardous healthcare waste. This however prevents a wider network of stakeholders from aligning on a viable approach to circularity. The misalignment observed in this study between the four European member states' legislations on (hazardous) healthcare waste management leads to a broad range of waste management practices. In addition, it can be concluded that there is no universal position in Europe on healthcare waste definitions, management, or valuation. The fragmented approaches reduce critical mass which lessens the incentive to develop systems, behavior, infrastructure, or products for a circular economy. A general fear of the risk of contamination of healthcare waste also makes it difficult to improve practices. Moreover, as current national waste handling legislations do not prioritize circular principles, it is worthwhile to re-evaluate the trade-off between safety risk and circular benefits.

Furthermore, there appears to be a triangle of conflict between economic value and incentive, legislation on plastic circularity, and technical capabilities. The perceived lack of economic value of recycling medical plastic waste results in limited investments in adequate waste management and recycling practices. As for legislation, legislation on recycling technologies and applications is not mature enough yet for plastic healthcare waste to be recycled into other (healthcare) applications. In addition, legislative differences on the categorization of (hazardous) plastic healthcare waste exist between European member states leaving healthcare facilities and waste processors with their own interpretations. Lastly, while various technologies exist that can recycle healthcare waste into healthcare and other applications, actual recycling practices of plastic (hazardous) healthcare waste are currently not taking place at a large scale. In short, the lack of perceived economic value of recycling plastic medical waste and the legal uncertainty regarding plastic medical waste (including recycling technologies and applications) result in ineffective recycling practices while various adequate recycling technologies do exist.

The research also showed that it can be difficult to engage healthcare facilities to provide details on their waste management practices as many are aware that improvements must be made while it is easier to approach those that have found creative ways to drive recycling despite all the barriers. It seems obvious that this can be the source of best practices and successful measures that will enable the sector to agree on common approaches which can drive the necessary standardization of waste management that goes together with products designed for recyclability and circularity.

Future Steps

In order to assess the robustness of the findings of this research, more interviews will need to be conducted with both healthcare organizations and waste processors. This research focused only on four countries and needs to be applied to more countries and to more healthcare organizations in order to extend and validate the conclusions.

The overall objective of this research is to collect data and engage stakeholders to work towards standardization of healthcare waste management to support the sorting into adequate waste streams and subsequent recycling into high quality recycled materials that can substitute virgin materials. This would include:

- Common waste categorization (including a definition of safe (to recycle) and unsafe (needing specialist recovery) plastic medical waste across and within countries).
- Recommendations for healthcare practices to prepare sorting and recycling.
- Recommended sorting practices at hospitals.
- Recommended sorting practice at recyclers depending on the recycling processes.
- Requirements and recommendations for necessary decontamination processes
- Any necessary labeling specific to medical technologies, devices, and packaging.

In addition, HPRC will build on the best practices of healthcare organizations regarding successful and effective waste sorting and recycling. New research has therefore been set up called *Transitioning Plastic Use in Healthcare from Linear to a Circular Economy Approach*. Hospitals' success stories in overcoming previously identified barriers to recycling plastic medical waste are central to this research. By doing this, an understanding of successful measures to overcome waste management barriers is gained and learnings can be shared with others in the healthcare industry for successful recycling practices. For this, HPRC is looking for healthcare facilities that are enthusiastic to share their best practices and their learnings after overcoming a waste management barrier and to learn from others so that we can collectively advance the recycling of healthcare plastics. Please go to this website and contribute to building an economy where all healthcare plastics are safely and effectively recycled and widely accepted as valuable resources.

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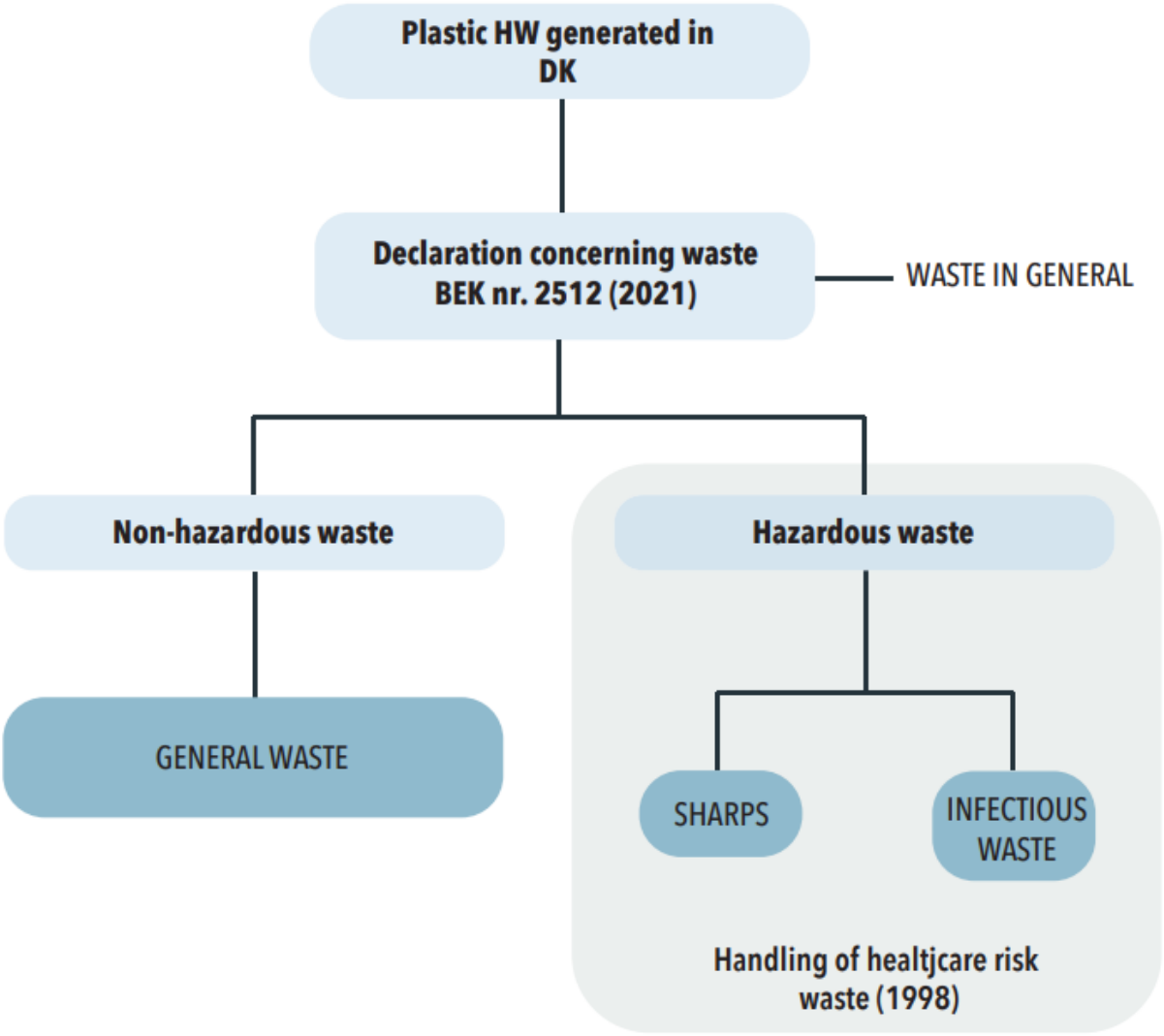
ANNEXES

Annex A: Anonymized List of Interviewees

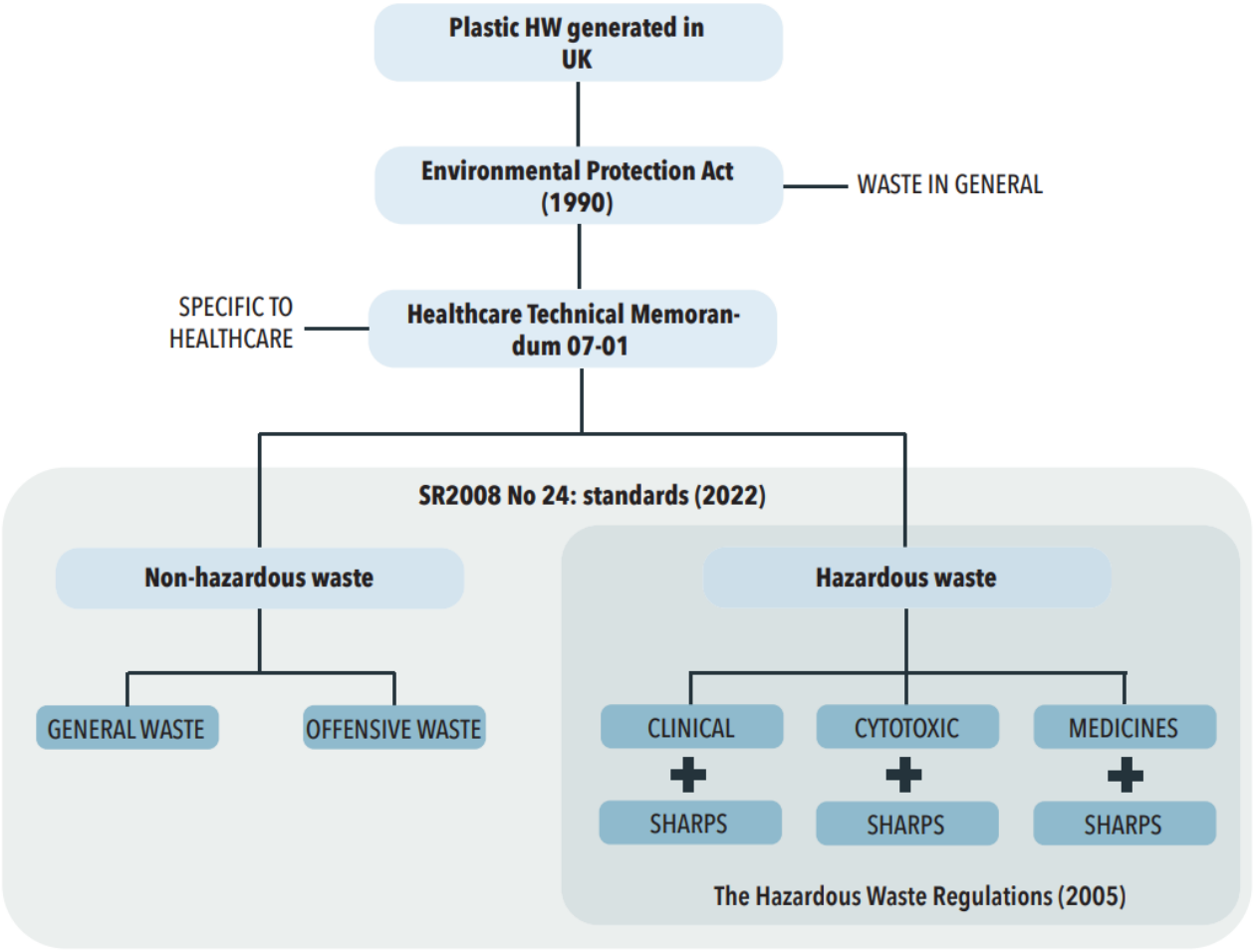
Denmark	CE Senior Advisor at an administrative region	Nurse at a hospital	Sustainability Project Leader at a Science Centre
	Environmental Coordinator at a university hospital	Nurse at a hospital	Plastics and packaging technology specialist at a technological institute
	Sustainability Consultant at a hospital	Chief Sustainability Officer at an innovative recycling solutions research company	Consultant at a waste and recycling management company
Germany	Nurse at a hospital	Packaging Engineer at a environmental service providing company specializing in waste	
The Netherlands	Team Leader Internal Logistics & Waste Management at a hospital	Midwife at a hospital	Midwife at a hospital
	Midwife at a hospital	Midwife at a hospital	Project Leader at an environmental services provided specializing in waste disposal, sorting and recycling
	Nurse at a hospital		
The United Kingdom	Waste and Recycling Manager at a hospital		
Europe	Policy Officer on Toxic-Free Consumption and Production at a European alliance organisation		

Annex B: Legislation on Plastic Healthcare Waste

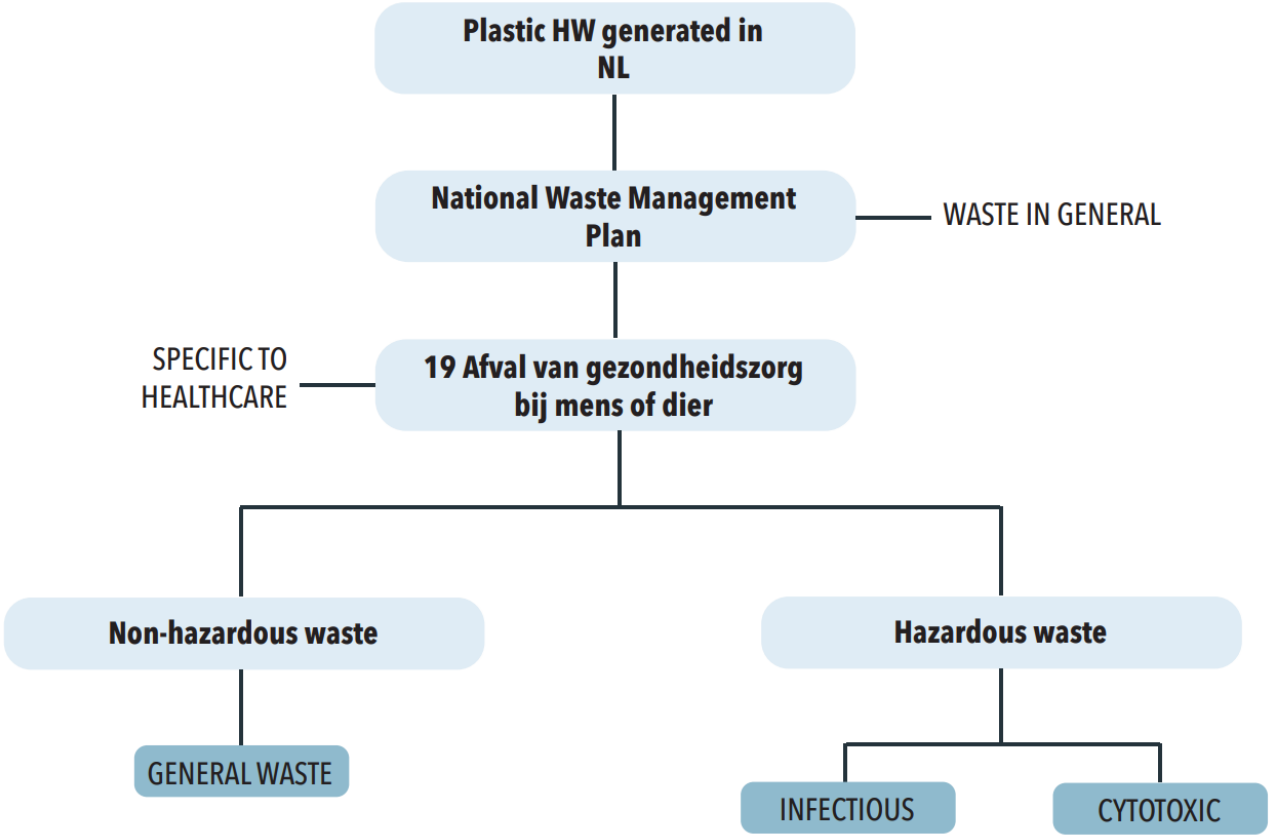
Annex B.1: Visualization of Danish Legislation on Plastic Healthcare Waste



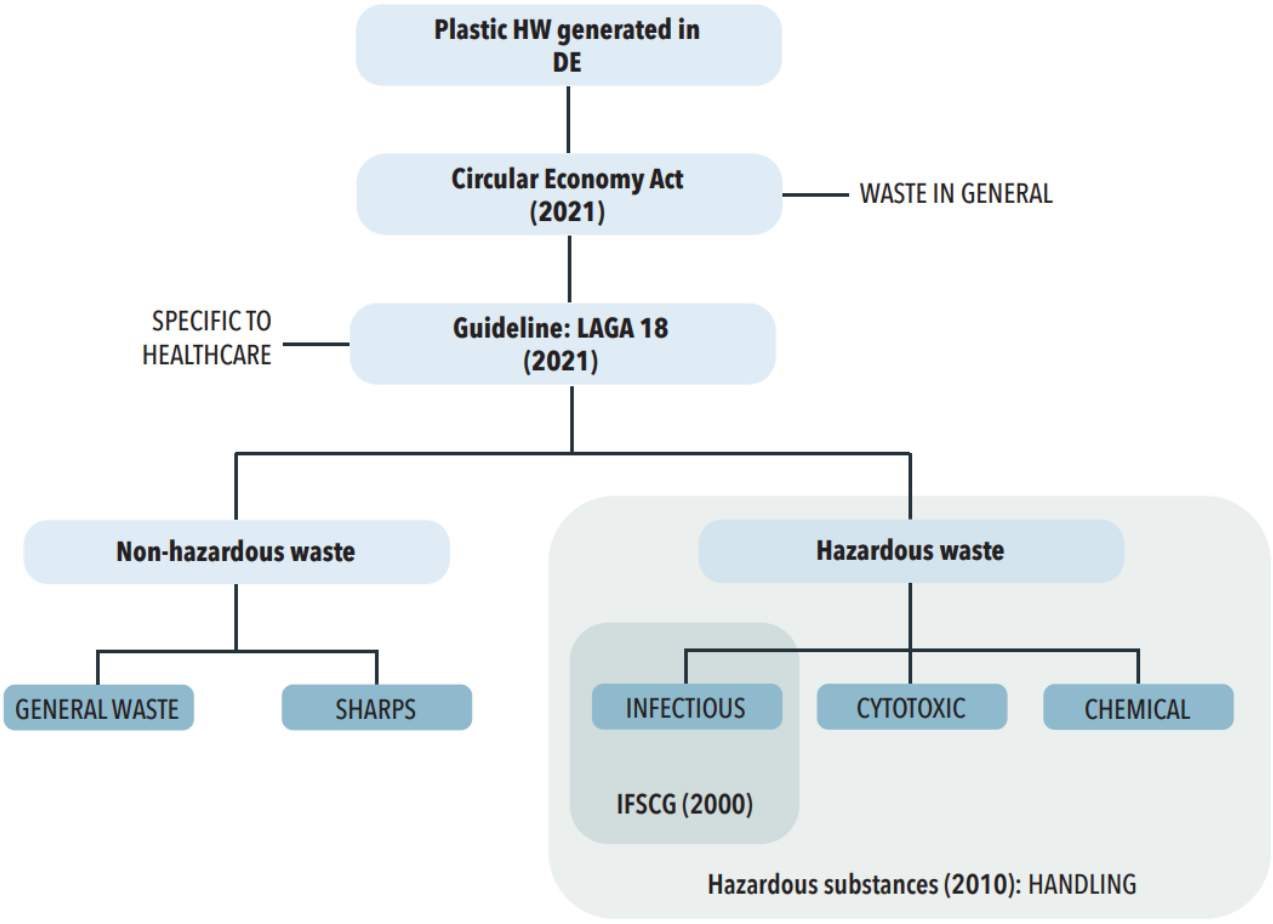
Annex B.2: Visualization of UK Legislation on Plastic Healthcare Waste



Annex B.3: Visualization of Dutch Legislation on Plastic Healthcare Waste



Annex B.4: Visualization of German Legislation on Plastic Healthcare Waste



ABOUT HPRC

HPRC is a private technical coalition of industry peers across healthcare, recycling, and waste management industries seeking to improve the recyclability of plastic products within healthcare. Made up of brand-leading and globally recognized members, HPRC explores ways to enhance the economics, efficiency, and ultimately the quality and quantity of healthcare plastics collected for recycling. HPRC is active across the United States and Europe working with key stakeholders, identifying opportunities for collaboration, and participating in industry events and forums.

For more information, visit *www.hprc.org* and follow HPRC on LinkedIn.

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